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IN THE UNITED STATES DISTRICT COURT FOR THE  
SOUTHERN DISTRICT OF NEW YORK

Midway Manufacturing  
Company - a Corporation

vs.

The Magnavox Company -  
a Corporation

and

Sanders Associates, Inc.,  
a Corporation

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74C1030

Civil Action  
No. 74 Civ  
1657 CBM

IN THE UNITED STATES DISTRICT COURT FOR THE  
NORTHERN DISTRICT OF ILLINOIS

The Magnavox Company, et al :

vs.

Bally Manufacturing  
Corporation, et al

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Consolidated  
Civil Action Nos.  
74 C 1030  
74 C 2510

FILED

DEC 1974

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General Stenographic Reporters  
369 ELGIN AVE., MANCHESTER, N. H. 03104  
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IN THE UNITED STATES DISTRICT COURT FOR THE  
NORTHERN DISTRICT OF CALIFORNIA

Atari Inc., a Corporation

vs.

The Magnavox Company, a  
Corporation

and

Sanders Associates, Inc.,  
a Corporation

For Midway Manufacturing and  
Bally Manufacturing

:  
: Filed, Even, Tabin & Luedeka,  
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CA No.

:  
: C 751442 WTS

:  
: Thomas V. Brandy, Esq.,

:  
: Sanders Associates and

:  
: Sanders Associates

James F. Williams, Esq.,  
11 West Washington Street,  
Chicago, Illinois 60602

Deposition of Ralph H. Baer taken  
pursuant to notice and subpoena by counsel for Midway  
Manufacturing and Bally Manufacturing at the offices of  
Sanders Associates, Daniel Webster Highway South, Nashua,  
New Hampshire, on Thursday, January 8, 1976, commencing  
at 9:45 o'clock in the forenoon.

Signature of Plaintiff

Barry G. Nolin, S.S.R.

PRESENT:

For Midway Manufacturing and  
Bally Manufacturing:

Fitch, Even, Tabin & Luedeka,  
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Stenotype Reporter:

Barry G. Nolin, C.S.R.

keeping of record RALPH H. BAER and 1945-47 other than called as a witness in behalf of Midway Manufacturing and Bally Manufacturing, being first duly sworn, was examined and testified as follows:

(Interrogatories by Mr. Welsh)

Q. Mr. Baer, were you able to obtain identification of the models of the TV sets that you were going to seek?

A. Yes, Mr. Welsh. I have them here. The small black and white RCA set is a Model AM122 with serial number 76GDA5138. The color set is an RCA CTC19 series, chassis is a CTC19U chassis, serial number 6264L4; and the small G.E. set, twelve-inch G.E. set at my home is a Model M152BVY, chassis SB, sugar, baker.

A. I think before we MR. WILLIAMS: Off the record for a second. (Discussion off the record.)

Q. (By Mr. Welsh.) What was the size of the screen of the RCA black and white?

A. Twelve-inch.

Q. Mr. Williams, was any further effort made to find a written statement of Sanders' policy regarding

keeping of record books around 1966-67 other than what is found in the front of Exhibit 16?

MR. WILLIAMS: Well, I guess we're still working on that. We're waiting for Mr.

Etlinger to return. He is supposed to be here this morning, and I think he is in the area, but he is not in his office, and when he gets back we'll take care of it.

4 Q. (By Mr. Welsh.) Now, if we could return to Exhibit 28 and Exhibit 16-31A, I believe when we adjourned, just before we adjourned, last evening you were trying to determine what were the present connections of the push button switch capacitors into the D.M.V. and the connection from the chroma-generator into the Delta Phi circuits?

A. I think before we left last night, Mr. Welsh, we had ascertained that the connection to the tank circuit of the chromaoscillator is indeed done via the capacitive ~~pole~~ voltage divider as indicated by the symbols C.I. and C206131A.

5 Q. In the bottom portion of that exhibit?

A. Bottom left-hand corner.

5 Q. And that is indicated in pencil, is it not, as a



A. correction? they are assembled on two adjacent bread-

A. Yes. The other question as to where the pumping circuit output was connected to the D.M.V. I did not resolve last night.

Q. That is, you did not resolve by examining the appropriate portion of Exhibit 28?

A. That's right, you do it, you said there are two sub-

Q. Did you not state that the circuitry of Exhibit 28 was made up of several, did you say, sub-breadboards which were soldered together and that at least some of those had been constructed in accordance with that

A. portion of the circuitry or the corresponding portion of the circuitry of Exhibit 16-31A? shown is

A. That's right. right-hand side of the page is still

Q. This may involve some repetition, but did not one of the sub-breadboards include the chroma-generator and the phase shift network in the lower center and the lower left portion of Exhibit 16-31A? the first

A. Yes, it does. the phase shifter is also on that first

Q. Did that also include the color gate?

A. Yes, it does. the power 1 in a circle on that

Q. Now, are all of those parts, then, at the bottom of Exhibit 16-31A assembled on a single sub-breadboard?

A. No, sir, they are assembled on two adjacent breadboards which is soldered together.

Q. If possible, I'd like to mark those and have some Scotch tape --

A. Magic marker would probably be easier if we had some. That will do it.

Q. Now, before you do it, you said there are two sub-breadboards, one, two, that include all of the parts at the bottom of Exhibit 16-31A. What does -- what parts are on the first one which includes the chroma-generator?

A. Circuitry contained on this board comprises the chromaoscillator, the summing amplifier. Shown in the center right-hand side of the page is still another circuit I would have to trace to identify.

The second board contains the color gate driver circuits, the color gate and reference gate diodes and associated networks. Returning to the first

breadboard, the phase shifter is also on that first circuit board.

Q. Could you write the number 1 in a circle on that board?

A. Yes, slightly to the left of center, on 16-31A is to be the (The witness drawing on exhibit.)

on board 1 located. THE WITNESS: I've done that.

5 Q. (By Mr. Welsh.) And then on the second one put a 2  
in a circle. (The witness drawing on exhibit.)  
and on this board. (The witness drawing on exhibit.)

collector of 1 K. THE WITNESS: Done that.

6 Q. (By Mr. Welsh.) Now, are the other parts of Exhibit  
16-31A present on other sub-breadboards of Exhibit 28?

A. I assume so, but I haven't checked it out in detail.  
The transformer, sixty cycle power transformer, showing  
in the center left-hand portion of 16-31A is present  
on another sub-chassis, and if you'd like, I'll mark  
that No. 3. to the outside of the chassis and connect-

17 Q. Fine. in an open connection.

19 Q. Now, that 10K resis (The witness drawing on exhibit.)

A. No, it is a 20K res THE WITNESS: I've done that. I

also see the diodes and capacitors associated with  
that transformer which generate square wave shown  
on 16-31A. Just time this was used. By positioning

18 Q. (By Mr. Welsh.) In the left center? (The witness drawing on exhibit.)

A. Left center portion on board No. 3. I just found

20 Q. a 51 ohm resistor. The vertical D.M.V. shown near  
the center, slightly to the left of center, on board  
16-31A is to be the two transistors centrally located



on board 3 located a quarter microfarad coupling capacitor which in conjunction with 100 K pot and 10 K resistor on the schematic through the timing, and on this board the capacitor which comes from a collector of 3 K, from a collector and a collector resistor with value 3K as shown in the schematic goes to the base of another transistor. That's correct. In this case the base goes to a purple wire via a 10K resistor. That's the means that is in place of these two resistors. Somewhere downstream 10K resistor was substituted and it goes out through the purple wire to the outside of the chassis and terminates in an open connection.

19 Q. Now, that 10K resistor is not shown on --

A. No, it is a 20K resistor. It is a minimum resistor shown as 20K here which indicates that the positioning control was somewhere external to the chassis, at least the last time this was used. By positioning control, I mean the 100,000 ohm potentiometer shown on 16-31A.

20 Q. Now, I'm not sure I understand completely. Is there a connection on Exhibit 28 similar to that indicated on Exhibit 16-31A with the letter A in a circle?

A. Yes, there is. There's a purple wire going over to the 10,000 ohm resistor which is in the same electrical position as this 20,000 ohm resistor shown on 16-31A. -- Ma.

Q. And is the 100K potentiometer -- I believe you indicated that was exterior of the chassis and not on that sub-breadboard, is that correct?

A. Yes, I think we'll find later that that was part of a joy stick mechanical assembly which had to live on the outside world, and just to verify that, let me see if I can find a return. The return should have been a ground, and here is a black wire emanating through the same hole. It traces back here and winds up -- well, yes, here's the return. The return or ground is done through a switch labeled off/on.

Q. Does that indicate that the connections or the connection of the conductor from the letter A in a circle into the D.M.V. as shown in pencil on Exhibit 16-31A is the correct showing of the connection on the corresponding part on Exhibit 28?

A. Yes. It also indicates that the schematic is correct. It is <sup>fairly</sup> merely clear now that that shows that somewhere along the line that control -- although electrically

in the same position as shown in 16-31A -- was moved physically outside the chassis.

3 Q. When you say schematic, you are referring to --

A. Exhibit 16-31A.

4 Q. Now, yesterday we referred to Exhibit 16-31 which --

MR. WILLIAMS: Excuse me, there's a pending question and I'm not sure he's finished answering it.

THE WITNESS: I lost ~~the~~ track of it.

MR. WELSH: Well, let's go back.

25 Q. (By Mr. Welsh.) Yesterday, Mr. Baer, in discussing the connection of the push button capacitors to the D.M.V. we referred to Exhibit 32, and did you not indicate that the manner of connection shown --

MR. WILLIAMS It's Exhibit 16, page 32.

MR. WELSH: Exhibit 16-32, thank you.

26 Q. (By Mr. Welsh.) And did you not state that the manner of connection as shown on that page was different from what was shown on Exhibit 16-31A?

A. Yes.

7 Q. So the connection that is actually present on Exhibit 28 corresponding to this connection is not what is shown on page 31 of Exhibit 16?

A. No, Mr. Welsh. Having just gone through the circuit and traced where the wires that leave the chassis terminate and made the judgment that the delayed multi-vibrator, delay volume 100K control was physically located outside, also placed the point listed as circle A outside and, necessarily, the control outside, so my assumption is that the schematic is exactly right. In fact, probably another minute's circuit tracing here will find the output of that pumping circuit which you call the capacitor, push button circuit, and will probably wind up in a wire hanging in mid-air somewhere, too. If you like, I'll go look for it.

28 Q. I don't think that will be necessary at this time. Now, there is shown the pumping circuit on page 3 of Exhibit 16, is there not?

A. That's correct.

29 Q. And that shows the connection to a circle A on the D.M.V., is that correct?

A. Correct.

Q. And this conforms to what is shown on Exhibit 16-31A?

A. Yes, and the purple wire really is connection A.

Q. If we may, now, return to the earlier question as to what components are on sub-breadboard 3?

A. I believe, so far, I identified the circuits starting with a power transformer, wave-shaping circuits, and the vertical delay multivibrator; and a minute ago I identified two additional transistors and associated components here with a horizontal oscillator found in the upper left-hand part of 16-31A. If you give me just thirty seconds, I believe I will also find the retrace gate, three transistors associated with the retrace gate on that same circuit board which we marked No. 3. That's correct. The retrace gate circuitry is on this board, also.

Q. That is sub-breadboard No. 3?

A. Sub-breadboard No. 3.

I believe I've covered everything on board No. 3.

Q. It would appear from your testimony regarding sub-boards 1, 2 and 3 that they include all of the components shown on Exhibit 16-31A, is that correct?

A. That's right.



Q. Were those sub-boards constructed individually?

A. Yes, <sup>you</sup> they would probably find a one to one correspondence between the sub-boards and the Exhibits 23 if you look long enough.

Q. I'd like to do that if we could to show whether there is a schematic for each of those sub-boards.

A. We already did it yesterday, Mr. Welsh. We correlated every one of the schematics in 23-7 with 16-31A.

Q. I realize that there were portions of 16-31A corresponding to parts of Exhibits 23, various pages thereof, but they were not segregated onto a breadboard organization. Perhaps there is not any such segregation of the different circuit elements. Do you know whether there is, or could you take a few moments, perhaps, and determine that by examining the Exhibits 23. I think you said you listed 9, 10 and 15 through 21?

A. If you would like me to go through Exhibits 25-7 on forward and call out the breadboards by No. 1, 2 or 3 on which they are located, I can do that very rapidly.

Q. That would be fine. Perhaps at the same time if you would either identify them by name or as to the portion of 16-31A where they appear, that would

provide a further correlation.

A. All right. Starting with a power transformer and the associated wave shaping networks and a sixty cycle clip are identified in the left-hand center of 16-31A. We find them again on 23-7 and find them on board No. 3.

Q. Now, in what portion of Exhibit 23-7?

A. I'm sorry. The top portion of 23-7. In the center of 23-7 both a horizontal oscillator and the video gating control circuits are shown. They reappear on 16-31A in the center of the page. That's not correct. They reappear on 16-31A as follows: the horizontal oscillator is at the top left of the page of 16-31A. The video gating control is simply another word for vertical delay multivibrator. It is on the schematic on the right center of 23-7 and slightly left of center in the middle of 16-31A, and it is located on board 3 near the center of the board.

Q. And the horizontal oscillator also is located on board 3?

A. Yes, near the right-hand edge of the board. Moving on to 23-9, the, what is here called the modified

and gate and is called the retrace gate on 16-31A are located on sub-chassis No. 2. The summing amp on 23-9 which reappears on 16-31A as an identical RCA <sup>operational</sup> ~~optional~~ amplifier on the right-hand of that schematic.. It is located on board No. 1. Figure 23-10 shows the gating circuit once more, just to repeat.

10 Q. Which gating circuit?

A. What we referred to as retrace gate on 16-31A and as modified and gate on 23-9. 23-11 we -- I had not looked at that before. It doesn't look familiar. I recognize what it is. 23-11 is a sketch of an earlier summing circuit which was used prior to the use of that RCA 3015 integrated circuit as a summer, so although there's no date on this, this must pre-date the sheets we've just gone through. It is out of order.

41 Q. I notice as you turned over Exhibit 23-10 that the back side of that also contains information and is identified as Exhibit 23-10A. I don't believe we've discussed that before. As long as we have that present, could you identify what's on that page?

A. Up near the right and the top of the page appears to

be a schematic of the horizontal sync generator or oscillator with the same values that we've seen used on a couple of these pages.

Q. And also appearing in the upper left of Exhibit 16-31A?

A. That's right. That's right. There are some other uncompleted schematics here which I can't identify, which don't appear to be on 16-31. 23-11 also has some uncompleted sketches which are unidentifiable. 23-12 has an, also, an earlier version of the circuit showing the horizontal oscillator, the wave shaper, much as it is shown at the top of 16-31 with an early version somewhat like the one we just came across on 23-11, and since that's undated, I guess that ties that together with 23-11 to some earlier date, like, possibly, the third of May. It also shows a very good delay multivibrator with the same values that reappear on 16-31A, center of the page under the heading V.D.M.V. Going to 23-13, we see a schematic of the phase shift -- I'm sorry, the chroma-oscillator and a driver circuit, the phase shifter, and what we've come to call the color gate circuitry, which appears to be a predecessor to that shown at the bottom of 16-31A.

3 Q. Now, of that, is not the chromaoscillator on sub-breadboard one?

A. That's correct. I'm sorry. I lost the trend of things here.

14 Q. And the color gate driver circuits, I believe you said, were on sub-breadboard 2?

A. 2, that's correct.

45 Q. And the phase shifter?

A. On sub-breadboard 1.

23-16, again, shows portions in the center of the page of the phase shifter and the color gate control circuitry several times over, and those are located, as we just said, on board 2.

23-17 is a more detailed analysis of the color gate control diode biasing networks and drivers on board 2 and 1 respectively, the driver being on board 1.

23-18 is an over-all schematic and has all the elements of 16-31 on it and, therefore, comprises circuitry located on all three boards.

46 Q. Are the components as shown on Exhibit 23-18 in a similar arrangement to that on Exhibit 16-31a?



A. Yes, they are.

Q. Perhaps, the connections are the same, but are not some of the various components in different locations on 23-18 with respect to the other parts than they are on Exhibit 16-31A, for example, the summing amplifier is shown in the center, approximately, of Exhibit 23-18, is it not, whereas, it is shown on the right on Exhibit 16-31A?

A. You are correct. The arrangement of the schematic on 23-18 differs from that on 16-31A, but the data is, roughly, the same.

Q. Is it possible that the parts in their arrangement on Exhibit 23-18 are more readily divisible into their sub-breadboard arrangements and as they are shown on Exhibit 16-31A?

A. The schematic is not a pictorial of how the breadboards were put together. We've already been through all the breadboard elements. I don't know how to answer your question. We've been past all of them, identified all these elements as to their location, already on board No. 1. de 2. e

Q. I think we were concerned as to whether there was any schematic showing all the components of each

sub-breadboard together?

A. Yes, and I would assume that this is it. We're looking at it on 23-18. It is all here. In addition to that, 23-19 is the block diagram of what's located schematically on 23-18.

50 Q. Except that, again, the locations of the parts relative to each other on Exhibit 23-19 are different from 23-18.

A. Well, there's no law, Mr. Welsh, that says you have to place elements of a circuit in the same physical location on a piece of paper.

51 Q. I am not finding fault with it; I'm just trying to reconstruct what occurred, and it appears that the arrangements of parts on 23-19 is more similar to that on Exhibit 16-31A with the summing amplifier in the right-hand portion of the page, for example?

A. That's right. Continuing with the correlation of the schematics in Exhibits 23 and the location of those sub-circuits on boards 1, 2 or 3; on 23-20 we, again, see the horizontal oscillator, which is located on board No. 3. We see portions of the sixty cycle wave shaping circuits and the variable delay multivibrator, an earlier version of it, near the

left-hand center of 23-25, and some other circuitry I can't identify. Well, that's correct, you are right. The portions of the wave shaping network that connects to the sixty cycle transformer on 16-31A are also shown on here, which would be located on board 3, also. In addition to that, near the right-hand side of 23-20 is another isolated schematic of the horizontal oscillator showing, which is also located on board 3.

52 Q. Now, as I understand it, board No. -- sub-board No. 3 contains the D.M.V. power transformer with the wave shaper and the horizontal oscillator?

A. That's right, sir.

53 Q. That's board No. 3?

A. Plus the retrace gate, which we picked up earlier.

54 Q. All right. I thought that was on No. 2. Could you go on?

A. Yes, all right. 23-21 shows the same horizontal oscillator once more, which is located on board 3. 23-22 we have not looked at before. It shows a circuit in the upper left-hand corner comprising a double <sup>pole</sup> ~~pull~~ double throw switch connected to two symbols representing potentiometers labeled vertical

\*

and horizontal respectively with the word joy sticks above it, shown above the potentiometers, and on the bottom left-hand side of that same page is an arrangement showing two switches, two similar <sup>pots</sup> ~~parts~~, but it is very sketchy, and it would be difficult to determine what all that is.

55 Q. That exhibit is undated, is that correct?

A. It is undated.

56 Q. And those parts are not on Exhibit 16-31A?

A. No, they are not.

57 Q. I think those are all of the drawings that you had referred to earlier as containing the parts that were on Exhibit 16-31A?

A. That's correct, yes.

MR. WELSH: Let's take a break and have some coffee.

(Whereupon, at 10:45 o'clock, A. M., a short recess was taken.)

AFTER RECESS    11:00 A.M.

Q.        (By Mr. Welsh.) When were sub-breadboards 1, 2 and 3 of Exhibit 28 constructed, Mr. Baer?

A.        I could only assume from what we went through here in the last day or so that they're <sup>were</sup> constructed simultaneously or close to the dates of the pages in 23, Exhibit 23, that we just went through.

Q.        Could you refer to any other documents such as Exhibit 16 to determine more accurately when the construction was done?

A.        Well, it appears from --

Q.        I believe it started on page 21.

A.        Well, page 21 shows a <sup>st</sup> chart date of 3/4, but we already know 5/3 is the date of some of the schematics, so I assume that 5/3 is, roughly, the beginning of the period when Harrison began to breadboard these circuits.

Q.        You said before I referred to Exhibit 16 that you assumed that the breadboards were constructed around the dates of the exhibits of -- I mean, the pages of Exhibit 23 to which you had just been referring. How did you happen to assume that? Those exhibits



don't contain any reference, do they, to actually constructing the parts?

A. But they do. Almost every page in Exhibit 16, as well as many of the pages in Exhibit 23, have Harrison's notes which are expressions of activity, and in some cases saying that he either measured something or has to do something, in other words, relating the physical activity of constructing, testing the circuits, which we just went through this morning.

Q. Could you refer to the pages of Exhibit 16, and from that, if you can, tell us when the various parts on Exhibit 16-31A were constructed?

A. Yes. Starting with page 21 in Exhibit 16, at the bottom of the page, contains the note that the above configuration was used to produce certain characteristics, which means that he just finished building the horizontal oscillator shown near the bottom of the page. In the middle of page 22 of Exhibit 16 is the notation that the above configuration was used to produce certain levels of video, and then a little below that, near the bottom of the page, are his comments that upon testing the above circuit such and such happened.

Q. Now, if I could interrupt you, you stated that the horizontal oscillator, apparently, had been constructed and was being tested as indicated on page 21?

A. Yes, sir.

Q. And you were referring to a note at the bottom of the page, I believe?

A. That's correct.

Q. Now, is there any indication as to whether that note was made that date, that is, the date of May 4th, opposite Mr. Harrison's name, or could it have been made at a subsequent date?

A. Well, since the subject closes at the bottom of the page and it is in the same ink, I would say it is made the same day. In addition to that, next to the left of the schematic, there is shown a series of voltage measurements which indicate the frequency versus voltage measurements, which indicates that the circuit was tested, measured. So there's no reason to believe that was done any other time except on the 4th, 4th of May.

Q. I believe you said that page 22 referred to the multivibrator -- off the record.

(Discussion off the record.)

7 Q. (By Mr. Welsh.) -- and did you indicate that that page -- and did you state that that page indicates that that configuration of multivibrator had been constructed on May 5th?

A. Yes.

58 Q. Now, the diagram in the upper portion of that page includes values for a fixed resistor which have been changed and, also, a value for a potentiometer which has been changed, is that correct?

A. That's correct.

69 Q. Is there anything on that page to indicate when that change was made?

A. Now, Yes, there is. I'm sorry. At the bottom of the page, Mr. Welsh, is a calculation showing that a resistor called R is equal to some values; in ~~turn~~ <sup>fact</sup> is equal to 3K, and if you look at the connection on the schematic up above, you'll notice that two values are crossed out and the value which is left standing is 3K, 3,000 ohms.

70 Q. Could that calculation have been added at a date later than May 5th?

A. Well, it doesn't look like it, simply because --

you can't tell from your Xerox copy -- it is all done in the same pen, whereas, a different pen was used on the next page, the next entry, so it looks contiguous.

1 Q. Is the pen used on 22 used on any later page?

A. It may be. It looks similar to others.

2 Q. On 25, for example?

A. That's right.

73 Q. Could we go on?

I believe we have kind of a pending question as to whether from these pages of Exhibit 16, which is Mr. Harrison's notebook, you are able to determine when the parts on sub-breadboards 1, 2 and 3 were constructed?

A. All right. Going on to page 23 of Exhibit 16, at the center of the page is a notation which says the circuit yields adequate, etc., which indicates that the circuit just above at the top of the page, vertical sinc circuit, had been tested. That page continues to page 25, 24 being a carbon copy.

74 Q. Now, before going on, is the vertical sinc circuit a part of Exhibit 16-31A?

A. Yes, it is.

Q. And where is that?

A. It is that part of the circuitry immediately behind the sixty cycle transformer. It comprises some of the wave shaping networks and the transistor you see just to the right of the transformer.

6 Q. O. K. Please go on.

A. All right. Going on to page 25 of Exhibit 16, the page starts out with the following words, "The preceding circuitry was assembled and made to operate in conjunction, etc." The whole page is a description of how the equipment performed in conjunction with a TV set.

77 Q. Now, what did the term "The preceding circuitry" refer to?

A. The schematic.-- block diagram, rather -- of pages 23 and 24, bottom half of the page, which are the over-all schematic of what is, essentially, 16-31A.

78 Q. Except for the color portion?

A. Except for the color portion which is not contained in the schematic of page 23 and 24.

79 Q. What does page 25 state? What is done with that circuitry at the bottom of page 23?

A. It states that the output of the circuitry shown



at the bottom of page 23 and 24 was applied to a Heathkit IG62 generation pin 7 of <sup>V</sup>~~vic~~ 8 which you'll find is the modulator and RF oscillator of the Heathkit so as to make it possible to connect the output to the TV set, and page 25 describes, in effect, that that was done and that on the TV set a split screen image appeared which is depicted by the pictorial in the center of page 25.

30 Q. Does that page state whether that was satisfactory testing of the apparatus or not?

A. It makes -- it says, in effect, it worked and points out a problem with respect to the sharpness of the border between the dark and the bright area and, also, makes the comment that problem was traced to poor low frequency response of the Heath generator. At any rate, it describes that he has the over-all system functioning right through the TV set that day.

81 Q. Now, another portion of the circuitry of Exhibit 16-31A is missing from that circuitry at the bottom of page 23, is it not?

A. What portion is that, Mr. Welsh?

82 Q. I am thinking of the summing amplifier.

A. That's correct. Instead of a summing amplifier, at

that point he simply used three resistors which summed sinc and video signal together and then applied them together to the Heathkit, and if you go back to page 25 at the bottom, the note, he says at the bottom of the page, he says, "We need a summing amplifier."

83 Q. And there is nothing corresponding to the retrace <sup>gate</sup> gauge?

A. No, because that's part of the color circuits which you just remarked are not part of the schematic -- block diagram -- on page 23.

84 Q. I thought the retrace <sup>gate</sup> gauge had to do with the division of the picture on the vertical line.

A. I'm sorry. You are right. It is the block which equals pulse shaping on the bottom schematic on page 23 is the same thing as the retrace <sup>gate</sup> gauge.

85 Q. Well, now, isn't there pulse shaping at the top of Exhibit 16-31A?

A. May I see that? I think we're going too fast. No, I think you are right. The pulse shaping is that capacity and diode network which is used to shape the output of the horizontal oscillator, make a reasonable facsimile of a horizontal sinc pulse.

At this point, that is, on the block diagram of page 23 in Exhibit 16, a retrace <sup>gate</sup> gauge did not appear.

86 Q. Now, in Exhibit 16-31A which includes the retrace <sup>gate</sup> gauge, do you know whether that had anything to do with the problem which Mr. Harrison stated in the central portion of Exhibit 25?

A. Yes, I just read the bottom of page 25 in Exhibit 16, and he suggests there that the problem of poor definition between the top and the bottom half of the split screen can be corrected with a clipper circuit, and he says, and his words are, "For the first problem, which was the definition problem, a clipper circuit was devised, continued page 26," and at the top of page 26 of Exhibit 16 is the clipper circuit which later came to be known as the retrace gate.

87 Q. Referring to page 26, beneath the circuit at the top is the statement, "This circuit allows negative level video to pass except during horizontal retrace time." What is negative level video?

A. Well, I think he means negative going or negative polarity video.

88 Q. Do you know?

A. Yes, because if you look at the wave form to the right slightly below that schematic, it shows a <sup>a</sup> rectangular wave form which goes between zero and minus 8 volts with a long time period at minus 8 volts, and the short time periods, which he marked in one place, 8 microseconds wide, being a zero. At 8 microseconds wide is the retrace time, the rest of the time is negative going video during the trace time of a horizontal line. So that's why I say that by negative video level he meant negative going, negative polarity video signals.

89 Q. What happens with respect to the beam during the negative polarity video signal?

A. It is meant to unblank the beam.

90 Q. And as you were describing the action of the beam, and you used the word trace, your left hand moved from left to right. Was that intended to indicate the movement of the beam across the screen?

A. That's right.

91 Q. During the unblanked period?

A. Yes, as I understand it. Now, that's what this does.

92 Q. And that is movement of beam from left to right as the time, the trace time, or the time when the beam

moves from left to right is the trace time?

A. Yes.

93 Q. And when it moves back from right to left, that's the retrace time?

A. Right. Would you like me to go on?

94 Q. Yes, would you please?

A. On the bottom of page 26 in Exhibit 16 is shown the schematic of the summer and the words below that schematic indicates that when he made the connection to the Heath IG62 he didn't have enough gain and had to do something, so that indicates that the work had been done, testing had been done on that schematic. Again, the date says it was done on the 9th of May.

95 Q. Now, what indicates that the work was done versus what the RCA summing amplifier could do?

A. First of all, the present tense of the sentence for a summing amp, and RCA 3019 operational amp, is used just above the schematic. Then he shows the schematic and he notes that the output of the operational amplifier is offset by minus 2 volts. You can't find that out unless you connect it and make a measurement. It goes on similarly right on to the next page which is the end of the description of what

he did and what happened when he interconnected the operational amplifier to the IG62 Heathkit generator. From there he proceeds into color control, and he makes an analysis of what's in the IG62 and then he says further experimenting found that various things happen when you try to take a signal from the IG62 chromaoscillator. That's in the bottom paragraph of that page, so that indicates he tested that oscillator, and the schematic of that oscillator, I believe, is the one shown to the right center on page 27, and it is the same as that which reappears any number of times and, finally, on 16-31A.

96

Q. Now, page 27 of Exhibit 16 near the top contains the statement which is underlined, "Next is color control," with color underlined again. Does that indicate that up to that time he'd been concentrating simply on black and white and had not made any effort to incorporate color?

A. That's correct.

97

Q. Now, also in the left center of page 27 appears another circuit which is crossed out with an X through it. What is that circuit?

A. I don't know, Mr. Welsh. It is a chromasoscillator



circuit, but I don't know where it came from or what its significance is here.

98 Q. Do you know when it was crossed out?

A. Well, it appears to be a circuit he first looked at, possibly for use as a chromacircuit, then decided not to use since a new schematic for another oscillator appears right next to it which was used.

99 Q. And do you know when the change was made?

A. I don't know. It looks like it was made right then and there.

100 Q. By then and there, do you mean on the date indicated opposite his name?

A. Yes, sir.

101 Q. And is that simply an assumption based on the fact that that date appears at the bottom of the page?

A. That's correct.

102 Q. Would you go on, please?

A. He describes in the paragraph just below the schematics the bench work he did and testing he did in making the chromaoscillator which he must have built. <sup>below</sup> ~~Below~~, he talks about lack of drive and changes values of resistance to allow it to operate <sup>2</sup> ~~re~~ more efficiently. ~~★~~  
The same thing goes for the last paragraph. On the

following page he makes -- he records tests of that oscillator versus various load resistor values. This load resistor in a tabulation near the top of the page shows what the frequency was and, also, lists the output voltages, so that the whole page up to the line that divides it from a section headed "Phase Shifter" is a series of tests he did on that oscillator, so that the oscillator really must have existed on 5/10, and 5/11, page 28 being dated 5/11.

103 Q. If I may interrupt a moment, I note that on pages 21 and 22 the date opposite your signature is one day behind or one day later than the date opposite Mr. Harrison's signature, and that on the subsequent pages 23, 25, 26, 27, 28 and 29 that go from dates 5/8 through 5/12 of '67, that the date opposite your signature is the same as that of Mr. Harrison; is that difference in the date when you signed these pages as indicated there to indicate any difference in operation or in your participation in this?

A. I'm sorry. I could only reconstruct this meaning that he finished the work towards evening, or I didn't have a chance to come into the lab in the afternoon after the work was even in progress or

finished and recorded, and I signed it on the next day when I first got to see the book in one case, and in other cases I was drifting in and out frequently enough to sign it on the same day. No other significance.

104 Q. Again, you are assuming rather than recalling, specifically?

A. That's correct.

105 Q. Go on, please.

A. At the bottom of page 28 of Exhibit 16 there is the heading "Phase Shifter," and Harrison here describes that we desire a phase shift of certain characteristics which should do certain things. As you go on to page 29, he says in the second sentence, "So will try certain phase shifter." Then he shows a schematic, and at the bottom of the page after going through additional circuitry he comments that the gate circuit appears to work, but loads the ~~face~~<sup>phase</sup> shifter, so, clearly, he had built the phase shifter, built the gate circuit, and tested the two together at that point.

106 Q. Now, is the portion of the circuit in the lower left of page 29 shown on Exhibit 16-31A?

A. Yes, it is.

107 Q. Does that portion bear the legend "Color Gate Driver?"

A. That's right, and the network below the color gate driver.

108 Q. Could you go on?

A. Yes. Page 30 is headed "Present Block Diagram." It shows in the top three-quarters of the page a block diagram of all the apparatus we have just been through, and at the bottom in dotted lines that part of the IG62 Heathkit which was used to take the composite signal and convert it to an RF signal modulated with the video for use with a TV set. There's a note on the bottom that says "Still using external power supplies plus and minus 9 volts," which tells me that that's what was hooked up that day, but I'm only guessing at that.

109 Q. Now, when you say that day --

A. The date of the --

110 Q. The date on page 30.

A. 5/15.

111 Q. '67?

A. '67. If you go to page 31 of Exhibit 16, now, we

see a record of bench work. There is, apparently, a problem in loading the phase shifter, so at the top of the page, "Will buffer phase shifter output and try for zero to 180 degree phase shift." Then comes the schematic and underneath are the words, "This buffer has solved the loading effect." So he built it, tested it. The next paragraph refers to his experimenting with some other part of the circuit. Do you want me to go into further detail, Mr. Welsh?

112 Q. Well, we're --

A. We're trying to relate what is going on to what actually happened or whether the hardware was built?

113 Q. Whether the hardware was built and when it was, yes, sir.

A. Yes, as a matter of fact, the last sentence above the bottom schematic refers to solving another problem by saying this was accomplished by changing horizontal sinc differentiating circuit, etc. It shows the gating circuits just below at the bottom of the page.

114 Q. Now, are the gating -- are the circuits -- which circuits are shown on the bottom of page 31?

A. The gate, retrace gate, the -- I'm sorry. The color

gate driver and the associated color gate and driver gate diodes and their bias networks.

115 Q. Shown on the lower right-hand portion of Exhibit 16-31A?

A. Yes, sir.

116 Q. Now, was the phase shifter circuit similar to the horizontal oscillator or multivibrator in being readily available or a circuit generally known at the time that Mr. Harrison incorporated it into this circuitry?

A. The type of phase shifter used here is generally known as a split load.

117 Q. And how about --

A. ~~The~~ Phase shifter ~~in his~~ generic --

118 Q. How about the color gate driver?

A. The color gate driver is a circuit specifically designed for this application. It was only standard in the sense that it uses a transistor in the function that it is designed for.

119 Q. And did Mr. Harrison create that design?

A. It appears that way.

120 Q. I notice on page 30, the block diagram which you spoke of, is that block diagram a diagram of the

circuitry on Exhibit 16-31A, is it not?

A. Yes, with the exception of the dash outline portion of the Heathkit.

21 Q. Right, the portion above that in the upper portion of page 30?

A. That's right.

122 Q. Could you go on?

A. On page 32 we come to a description of what he calls a pumping contest underlined and in parentheses at the top of the page. Just below that is a schematic of, it looks like, a test to see how far the vertical delay multivibrator could be moved with respect to sync by changing the voltage on the bottom of the base resistor for the second stage which is shown as a 30,000 ohm resistor on this schematic. In this is that same point we have discussed a number of times in connection with 16-31 with the circle A. And he shows everything, made some measurements. To the right of that schematic it says here that for minus 6 volts applied to that point he got a 3 millisecond delay for 6 volts. For zero voltage he got 11 millisecond delay, and for plus 9 volts he got 13 milliseconds of delay.



Now, there is some other indications that he worked on the circuit in a small note he made in the middle of the page, and to the left of the page segregated by a line around it in the left lower corner and headed with a date 5/16/67, R. H. Baer, in Harrison's handwriting is the word "First game, pumping contest." Below that is a pictorial showing two switches, and I believe the reference to 5/16/67, R. H. Baer, is a reference to a piece of paper I drew which, I believe, we've already come across previously which was done by me and shows the business of using two push buttons for a pumping game. So it is to the effect that he copied that out here, and then created the circuit to the right of it, the bottom right of page 32, which we've gone over, and he says -- well, he comments on what the circuits should do on the bottom left-hand side on page 32.

3 Q. I wonder if we could take a moment to find that other paper.

A. It is somewhere in this pile.

MR. WELSH: Off the record.

(Discussion off the record.)

14 Q. (By Mr. Welsh.) Now, you referred to the belief

that the portion of Exhibit, or page 32 of Exhibit 16 in the lower left corner bearing the date May 16, '67, with your name in parentheses included material on a paper that you had prepared and from which Mr. Harrison copied. You just searched for that. Is that paper Exhibit 9-64?

A. Yes, it is.

125 Q. 9-64 is a part of a group of papers which are connected together, is it not?

A. Yes, it is.

126 Q. And 9-64 bears a date 5/16/67 and your signature, does it not?

A. Yes.

127 Q. Could you tell us what this group of papers is?

(Documents handed to the witness by Mr. Welsh.)

THE WITNESS: This group of papers contains one or more ideas for specific TV games on each of the pages stapled together in this group.

128 Q. (By Mr. Welsh.) Did you prepare this group of papers?

A. Yes, I did.

129 Q. What was the occasion for your preparing the group?

A. To the best of my recollection, that's -- those were ideas put together in order to guide us in constructing equipment that would play the games described in these pages.

130 Q. Now, up to this point you have pointed to or you have noted in Exhibit 16 entries which indicate construction of various ones of the circuits on Exhibit 16-31A which are on sub-breadboards 1, 2 and 3 of Exhibit 28. Is there any indication in any of these documents indicating or indications of combining all of those circuits into the complete apparatus as depicted in Exhibit 16-31A?

A. No.

131 Q. Do you recall whether that was done prior to this time, that is, May 16, 1967?

A. No, I do not.

132 Q. Did you prepare these documents, 9-64 through 9-68, alone or during consultation with or as a result of consultation with others?

A. I can't, <sup>possibly</sup> ~~probably~~, remember that nine years later, Mr. Welsh.

133 Q. Now, if we may return to page 32 of Exhibit 16, and the chronology of building and using the apparatus

portions thereof in Exhibit 16-31A, could you proceed?

A. Yes, sir. Having recorded on page 32 in the lower left-hand corner a partial replica of what I call the first game on 9/64 in my notes, he proceeded to draw -- appears to have copied my circuit of the switches and the pumping capacitors and then added to that their interface with what is shown as point A on the delay multivibrator on my sketch 9/64. And that interconnection is shown at the bottom of page 32 in Exhibit 16; and going on to the next page, page 33, on the following day at the top of the page in his handwriting there are the following words: "Circuitry and control on previous page were assembled and via a paper overlay on TV screen the first contest was played between R. H. Baer and W. Harrison," and the words: "The first contest," and so on are underlined. Then he goes through an exposition of some problems that were encountered in the middle of the page and talks about what he thinks ought to be done, and he talks about another problem in the bottom paragraph and then shows a circuit at the bottom right-hand corner of the pumping circuit and interface to the delay multivibrator.

That's probably different, but I would have to wait here a second and take a close look. Well, you can tell at a glance that what he was doing was changing parts values in order to get the circuit <sup>to work</sup> board properly. \*

134 Q. How can you tell that?

A. Because parts values are crossed out and replaced by others and, in particular, you'll note that the capacitors that are labeled C1 and C2 on page 33 were changed from a hundred microfarad to ten microfarad and that is the solution, or was the solution, to what he calls the second problem in the bottom paragraph on page 33. I see what the problem was. Initially, he started off with two 100 microfarad capacitors, attached the pumping switch which were then discharged when you press the switch into another 100 microfarad capacitor, so that, <sup>by</sup> basic physics, about half the voltage of the first capacitor appeared on the second one, which meant that you pumped up the second capacitor too rapidly. When he went to the bottom of page 33 to 10 microfarad instead of 100 microfarad, that problem disappeared. All of this by way of suggesting that he was actively \*

working on this circuit, solved the problems on 5/18/67.

Q. The note at the top of page 33 also contains a notation, "Winner's name will be withheld."

A. I don't remember who won the first game.

MR. WELSH: This might be a good time to break for lunch.

(Whereupon, at 12:00 o'clock, noon, a recess for lunch was taken.)

AFTER LUNCH 1:45 P. M.

MR. KATZ: I'd like to make a request. As I mentioned before when I was numbering a group exhibit, No. 9, I found that we didn't have a copy of 9-91, which is a schematic drawing with various pencil notes on it, and I'd like to get a copy of the backs of 9-117 through 9-120. There's material on the backs that appear to be relevant.

MR. WILLIAMS: Are they numbered 117A and --

MR. KATZ: No, these were unnumbered

backs, and there looks like pencil notes with names of various people on it like Mr. Rusch, Mr. Baer, Mr. Harrison's name on the backs, perhaps signatures. Also, I notice that there's a report which is 9-137 through 9-173. Those are the pages of the report. It is, I believe, attached to an invention disclosure form.

MR. WILLIAMS: 137 through --

MR. KATZ: That our copy is incomplete in the sense that it is a handwritten report and the extra material is cut off, because the paper was, apparently, larger than the Xerox size setting so that it didn't need a reduced copy like what was done on other ones that were oversized. Those are the things I'd like to get copies of so that our file of that group Exhibit 9 could be complete. Attached 9-137 through 9-173 is the handwritten material that's attached to the form, Sanders form. Some of it is cut off on ours.

MR. WILLIAMS: Looks to me like some of the exhibit, itself, is also cut off.

MR. KATZ: Yes, I checked the originals. I see that the original, itself, is a copy,



but there are some pages where ours is less than what was in the original. In fact, the originals seem to be intact in most places. I notice there are some foldouts, too, pages that fold out, and that was missed on the copy. I just happened to notice that as I was putting the numbers, reforming our copies to the original exhibit. O. K. That's all, I think.

MR. WELSH: Did you fix the time when you might expect those?

MR. KATZ: No. Could we get those copies sometime next week?

MR. WILLIAMS: Do you expect to be using those this afternoon?

MR. KATZ: No, but we'd like to go through the copies in preparation for the next session.

MR. WILLIAMS: I suggest we pull them out right now. The easiest way to get them done quick is to get them done right now.

MR. KATZ: Fine.

MR. WELSH: Could I have the last two questions and answers before the recess,

please?

(The last two questions and the answers were read back by the reporter.)

136 Q. (By Mr. Welsh.) Do you have the original of 9-64?

A. Yes.

137 Q. Your original pumping circuit shown on 9-64 did not include any values of circuit elements, such as resistors and capacitors, is that correct?

A. Yes.

38 Q. Then did Mr. Harrison determine the values in the pumping circuit in the bottom right portion of Exhibit 32?

A. Probably.

39 Q. I'm sorry, page 32 of Exhibit 16. Was he the one who changed the values from those shown on page 32 to those shown in the circuit diagram on page 33?

A. Yes.

Q. Is the interface between the pumping circuit and the D.M.V. as shown at the bottom of page 33 of Exhibit 16 the same as that used in connection with Exhibit 16-31A? Is the one on page 33 the same as on 16-31A?

A. Please repeat the question. I am lost.

Q. Is the connection of the pumping circuit to the D.M.V.

as shown at the bottom of page 33 the same as it is as shown in Exhibit 16-31A?

A. No, sir.

42 Q. Then, if I understand correctly, the connection at the bottom of page 33 is not the same as was used as shown on Exhibit 28?

A. Mr. Welsh, 16-31A doesn't show any connection, simply because that circuit hadn't been designed when 16-31A was drawn, and I think we've got a problem with -- well, I don't have a problem, but there's a problem here with keeping in mind what happened consecutively. I can't answer the question because, simply, there need not be any relationship between that connection on page 33 and 16-31A because the work on 33 wasn't done until after 31A was completed. I believe we've been all through that.

143 Q. Well, I believe you stated that the pumping circuit connection into the D.M.V. of Exhibit 28 is the same as was shown on Exhibit 16-31A?

A. Yes, and that it is, except that --

144 Q. Now, on the bottom of page 33 is a portion of the D.M.V. shown?

A. Yes.

5 Q. And is the connection of the pumping circuit to the D.M.V. shown?

A. Yes.

46 Q. Is that connection the same as it is on Exhibit 16-31A?

A. I'm sorry. There is no connection to the pumping circuit on 16-31A. I cannot answer that question. May I help?

147 Q. Well, the point where the pumping circuit is connected is known, is that correct?

A. Well, it is grounded in this case. It's the grounded end of the hundred thousand ohm resistor.

148 Q. It is the end opposite the grounded end, is it not?

A. No, sir, it is this end. Once more, if you look back and think, we discussed that, what was done here. The schematic was to lift the grounded end from this end, the upper end of the hundred thousand ohm resistor and inject the pumping voltage at this point, and that's what is shown on the bottom of page 33.

149 Q. But that's not shown on 16-31A?

A. No, when we talked about that, we anticipated -- I don't recall, but it probably came about, because we went through this Exhibit 16 here.

the pumping circuit, and if I may hazard a guess, somewhere later, in order to tie things together for the sake of recognizing how things go together, I suspect I put this connection and the circuit letter A in here to refresh my memory that that's an appropriate point at which to inject the output of the pumping circuit, and that's basically how it was interconnected.

155 Q. And did you, I believe, also state that you made the correction in pencil in the manner of taking the output of the chromaoscillator into the phase shifting circuit?

A. Yes.

156 Q. Do you remember when that was done?

A. No, sir.

157 Q. Was that done after May 15, 1967?

A. I can't say.

158 Q. Well, it was not done before May 15, 1967, was it?

A. No, certainly not.

159 Q. So it was done after that?

A. Yes, I believe I already testified to that, sir.

Something we probably did to reduce the loading on the oscillator. It is common procedure. It is

called tapping down on the tank circuit, and we had previously gone into this chassis here.

160 Q. That's Exhibit 28?

A. Of Exhibit 28, and showed the connections, and they are made as shown by the pencil sketch and capacitors on 16-31A.

161 Q. What other changes or additions to the original drawing of Exhibit 16-31A appear on that exhibit?

A. Explanatory <sup>and</sup> notations that identify the various sections with titles, such as retrace gate, summing amplifier, and the like, to make it easier to read the schematic.

162 Q. Would you read all of those into the record, please?

A. Certainly. At the top of the page, 15,735 horizontal oscillator, on the output line, above the output line from the oscillator, horizontal pulse shaping and a wave form. Next to those words, at the left of the schematic, the transformer, the 60 cycle transformer and rectifier which provides the input width for the vertical pulse shaper was pencilled in. The first capacitor following the diode which I pencilled in or, rather, inked in was

identified as a hundred microfarad. The next square wave symbol was placed next to the peak to peak diode clipper as identified on the schematic. The words 60 cycle clipper were placed above the following transistor stage. A wave form and the lettering V-PDMV for pulse delayed multivibrator was placed above the delay multivibrator. Symbol for a semi-adjustable control circled with double lines in it was placed above the hundred thousand ohm potentiometer. Plus 9 volts was placed above the connection to plus 9 volts of the 33K ohm resistor at the collector of the second stage in the D.M.V. A wave form was drawn and identified by numbers and just below the output of the D.M.V. The abbreviated word horizontal sinc, H. sinc, and an arrow was placed before the input to the retrace gate. The retrace gate circuit was identified by placing the word retrace gate in a block above it. The video input line to the retrace gate is identified by an arrow and the words video in. The output of the retrace gate adjacent to the output is a block with the word in it and at the bottom right-hand side of the page there is an asterisk which has the following



legend next to it: composite video with the word wave form underneath crossed out. Then, there are a couple of wave forms next to the resistors which sum the output from various parts of the circuit together, and they are crossed out. They were meant to represent vertical and horizontal wave forms, and the letters V and H are still there. The wave forms are crossed out. At the input to the summer there's another block with the word C#. The number sign reappears in the corner bottom right-hand side of the drawing, and next to the number sign are the words composite output. Then I added the block above the color gate driver with the words color gate (diode) driver inside the block and an arrow with a letter H for horizontal is also shown just above the 3300 pf capacitor leading to the input of that gate transistor. Two arrows are shown emanating from the 21 and 914 diodes at the output of the color gate. There are also the words color gate above the top-most diode, and the word ref for reference gate below the bottom-most of those two diodes. I added a few dots; in fact, I added dots throughout the schematic to indicate

connections. They make the diagram easier to read, because Mr. Harrison used an old-fashioned notation in the schematic of using semi-circles to denote non-connections and simply the intersections between two lines to denote a connection. It is easier to read connections when there is a dot there, so throughout the schematic wherever there is a connection, in accordance with appropriate practice, I put a dot. I also added, starting from the bottom left, the word frequency adjustment and an arrow next to the time capacitor across the crystal in a chromaoscillator. The numeral 3.599545 Xtal-- for crystal -- with a line pointing towards the crystal above the chromaoscillator crystal. The voltage measurement 3 volts D.C., 3 V.C.D., at the source connection of the 2N4302 fieldeffect transistor in the chromaoscillator. Symbol denoting a semi-adjustable control just above the 50,000 ohm potentiometer and the phase shifter, and above that the Greek letters Delta and Phi. The symbol points towards the 50,000 ohm resistor, and underneath the circuit there is a standard symbol denoting angle with the numeral 0° inside followed by the word

reference and an arrow pointing towards the right towards a hundred pf capacitor at the lower output of the phase shift circuit. The angular number  $0^{\circ}$  to  $180^{\circ}$  with an arrow pointing towards the upper output of the phase shifter, and I believe that sums up all the annotations I made in ink.

3 Q. Did you also add the words schematic?

A. I'm sorry. In the bottom right-hand side corner there is the word schematic.

64 Q. Do I understand correctly, then, that you made all of the changes that are in ink on this drawing, also, the ones you've just been describing?

A. The additions, yes.

65 Q. What occasioned your placing these additions on the diagram of this exhibit?

A. I don't recall except that I did it at some time in order to make it easier to read the schematic. I dislike schematics which do not identify working sections. They're hard to read.

66 Q. When did you make these additions?

A. I don't recall, Mr. Welsh.

67 Q. Was it around the time we've been discussing in mid-May of '67 when this work was going on?

A. I simply don't know.

168 Q. You don't know whether it was then or later?

A. I don't know whether it was then or later, that's correct.

169 Q. On the date which is indicated as May 18, 1967, the date for page 33 of Exhibit 16, were all of the breadboards or sub-breadboards numbered 1, 2 and 3 interconnected to form the complete circuit as shown in Exhibit 16-31A?

A. Mr. Welsh, the circuits shown in 16-31A were used and had added to them the circuits shown on the bottom of page 33 several days after the -- three days after -- 16-31A was drawn, so I can't understand your question.

170 Q. Could you read the question?

(The last question was read back by the reporter.)

THE WITNESS: I understand now.

The answer is yes.

171 Q. (By Mr. Welsh.) Is that the first time that these breadboards were so interconnected?

A. Apparently. I can only judge from what we read here.

172 Q. There is nothing that we've gone through to indicate

an earlier date, is there?

MR. WILLIAMS: If you recall.

THE WITNESS: Not that I can recall. May I double back for one more second?

173 Q. (By Mr. Welsh.) Yes.

A. Are we talking about the interconnection between the pumping circuit and the D.M.V. which is what is shown at the bottom of page 33? Are you asking me whether this is the first time -- that is, 5/18/67 is the first time -- the pumping circuits were interconnected as shown on page 33 of Exhibit 16, or whether I recollect having seen them connected at some earlier time?

174 Q. I was not referring to the pumping circuit on Exhibit 33. I was referring to the three breadboards which contained the circuits shown on Exhibit 16-31A?

A. All right. I would have to answer that with the 15th of May, <sup>as</sup> ~~is~~ the first time they all came together, physically, as a working entity in accordance with figure 16-31A, simply because we just proceeded back through the entire step by step design of each individual circuit in Harrison's notebook

\*

and notes and saw that it all came together, finally, on page 30 of Exhibit 16 and page 31 which added the color feature to the balance of the circuit.

175 Q. I realize that Exhibit 16-31A shows all of the various circuits that we've been discussing and bears a date of May 15, '67, which, I believe, you stated indicates that it was drawn on that day. My question was with respect to the actual interconnection of the circuits, the various component circuits to each other as shown in Exhibit 16-31A.

A. The answer is yes.

176 Q. Yes that that occurred for the first time on --

A. The 15th of --

177 Q. Why do you say the 15th instead of the 18th?

... The 18th, I believe, was the date when it was stated that the first contest was played on page 33 of Exhibit 16.

A. Well, because the entire schematic was drawn on the 15th, and it is pretty well established now, having gone over the detailed schematics a number of times, that it accurately reflects all those sub-schematics that we had gone through in Exhibit 16 and in Exhibit 23, so it is my assumption that the hardware

was essentially finished and working on the 15th, especially since Harrison appeared to have been busy on the 16th building my pumping circuit as shown on page --

178 Q. Why do you say on the 16th he was busy building your pumping circuit?

A. No, that's incorrect, on the 17th.

179 Q. The 16th was the date of your notes in Exhibit 9-64 and 9 -- well, 9-64, 5, 6 and 7; is that correct?

A. That's correct.

180 Q. Isn't it possible that this drawing, Exhibit 16-31A, might have been completed before the actual inter-connection of the various circuits was made?

A. It is possible that it may have happened by a day or so.

81 Q. Referring to page 33 of Exhibit 16, when did you place the notation at the top of that page, "Note, first contest played?"

A. I don't know.

82 Q. You did state it was subsequent to that date, did you not?

A. Yes.

83 Q. Do you remember the circumstances under which you



placed that note there?

A. Yes, only by inference. I notice that the ink's the same as that used to make the annotations on 16-31A, so I think it was part of that same effort to highlight the specific places that I wish<sup>ed</sup> to get back to, in the various books, rapidly.

184 Q. This was in one of your --

A. I imagine, one of my clean-ups, fits of orderliness.

185 Q. One of your efforts to assemble the materials relating to the development of the TV games?

A. That's right, sir.

186 Q. And that took place sometime after May 18, 1967, did it not?

A. Very probably.

187 Q. You did not date that entry of that note on page 33, did you?

A. No, sir.

188 Q. Any reason why you didn't? No particular reason?

There appears to be underscoring on that same page, does there not? I believe you indicated that earlier?

A. Yes.

189 Q. Who did that underscoring?

190 A. Now that you call my attention to it, it appears to  
be in the same ink as that which the note we just  
discussed is done in, so I would assume I did the  
underlining, again, to call attention to the particulars.

Q. And did you do that at the same time that you placed  
the note at the top?

191 A. I would assume so.

Q. Do you recall?

192 A. No, sir.

Q. Did you do this particular clean-up in which you  
made these notes on page 33 of Exhibit 16 and on  
Exhibit 16-31A at the request of anyone?

A. No, sir.

193 Q. Do the documents which we have discussed thus far  
bearing dates prior to May 18, 1967, represent all  
of the documents which you were able to find  
relating to TV game development up to that time?

MR. WILLIAMS: Mr. Baer, don't  
hesitate to look through all the documents if it is  
necessary.

THE WITNESS: It is quite possible  
that somewhere in the collection of documents before  
us, that we haven't gone through yet, there are others

that bear the same date, because I miscolated, and it is also possible that some of those that are undated were placed where they are because at the time they were placed, they were thought to <sup>relate</sup> ~~produce~~ to the particular dates they are adjacent to but might actually be earlier pieces of paper. Beyond that, I assume the answer to your question is yes.

194 Q. I would like to have you go through these documents and answer that question, but before you do so, I find that -- I note here in Exhibit 13, which I call your attention to, I'd like to have you mark that question so we can return to the previous one. Do these documents which you are holding relate to TV games and bear dates earlier than May 18, 1967?

A. Yes, they do.

195 Q. Could you take them in order and tell us what they show, please?

A. There are three documents starting with -- I'm sorry. Numerically, the first document is 23-23. It is out of sequence in terms of its chronology, because it is not dated. It wound up where it is, but I think we'll find that it should really be associated with papers that describe work done a few days later,

so if you don't mind, I'll put that aside.

196 Q. A few days after May 18th?

A. 15 through 18.

197 Q. Well, now, I am speaking about --

A. 18; Q. K. Yes, 18. There are three papers here dated the 15th. They're 24-25 and 24-26.

198 Q. Of group Exhibit 23?

A. 23-24 appears to be a sketch in Mr. Harrison's handwriting showing the over-all system of the TV game, essentially, as is reappeared again in -- I'm sorry. May I have Exhibit 16 back? That one.

(Document handed to the witness by Mr. Welsh.)

THE WITNESS: 16-31A. In fact, it is obvious that 16-31A is the schematic representation of the block diagram of 23-24. There are also references on that page to the work done on that date in the middle of the page of 23-24.

199 Q. (By Mr. Welsh.) What do they indicate was done on that day?

A. They indicate that he, Mr. Harrison, was experimenting with getting "larger squares," his words. That's not too clear, Mr. Welsh, what he was doing. Referring

\*  
\*

to the paragraph on the bottom third of the page, I can't reconstruct what that meant. Shall I go on?

200 Q. Before you leave that, I believe you stated that the portion at the top was a sketch of the over-all system of Exhibit 16-31A.

A. I'm sorry, Mr. Welsh. I said it is the block diagram represented by 16-31, but thumbing back onto page 30 of Exhibit 16 it now appears that 23-24 is simply the pencilled sketch which preceded Harrison's ink entry into the book on the same day.

201 Q. I would suggest that you compare those two, because it would appear that the block diagram at the top of page -- or Exhibit 23-24 is of apparatus intended to produce a moveable dot as stated at the top of that page, is that correct?

A. I am afraid I was hasty, again.

202 Q. And that is not shown in Exhibit 16-31A, is it?

A. No, it is not. As a matter of fact, this is the beginning of different work, so 23-24 does not contain information which is part of -- contains information which is not part of 16-31A.

203 Q. I believe the question was, the earlier question, was with respect to whether we had considered all

documents relating to TV game development prior to May 18th of 1967?

A. It is clear from what we just discovered in 23-24 that there was other activity prior to 5/18/67 as recorded on 23-24. If you'll give me a minute to read 23-25, I will try to figure it out.

Q. Before you do that, you just made a statement that there was other activity. What do you mean by other activity?

A. Activity related to a design that we had not encountered up to this minute in going through the various papers.

Q. Did you also mean, perhaps, activity other than that represented by the apparatus and schematic diagram of Exhibit 16-31A?

A. Exactly.

Q. Now, could you go on?

A. 23-25 is a series of notes by Harrison in which he effectively talks to himself and what the effect of doing various things to the delay multivibrator would result in in terms of the final appearance on the screen. The page is headed "to produce lines." It is clear now. The next word is horizontal, underlined, which I take it to mean to produce horizontal

★

lines, you do the following, and the following are --  
 in his words -- are negative D.C. voltage gated  
 by variable vertical pot, short for potentiometer.

<sup>d</sup>  
 U<sup>^</sup>nerneath is the word vertical and the words negative \*  
 D.C. voltage gated by variable horizontal pot, and  
 then the word or, and underneath that sinusoids to  
 one D.M.V. at a time.

207 Q. Did you discuss the particular work with him?

A. I couldn't possibly remember that now. Shall I go  
 on?

208 Q. Yes, what is Exhibit 23-26?

A. Two days later, on the 17th of May, '67, yes,  
 Harrison discusses the desire to control the delay  
 of a delay multivibrator, which equals a sixty cycle  
 delay multivibrator via a changing voltage, and then  
 he shows a schematic which he heads with the words,  
 "The following preliminary step was taken, and the  
 results are as follows." It seems to me we've gone  
 through that before. This voltage value is that  
 next to the schematic that relates to the time delays,  
 achieved by varying the voltage on the bottom ends  
 of the 30,000 ohm resistor connected to the second  
 gate in the pulse delay multivibrator to show what

delays he obtained by varying the voltage within those limits.

Q. That was in a prior discussion was in connection with page 32 of Exhibit 16 bearing the same date, is that correct?

A. Right.

(Whereupon, at 2:50 o'clock, P. M., a short recess was taken.)

AFTER RECESS      3:00 P. M.

MR. WELSH: Could we have the last question and answer, please?

(The last question and the answer were read back by the reporter.)

Q. (By Mr. Welsh.) And that related to the pumping circuit, did it not? We're talking about the Exhibit No. 23-26, and you agreed that that contained information similar to that on page 32 of Exhibit 16?

A. Yes, that's correct.

Q. So that all relates to the pumping circuit rather than the moveable dot subject matter referred to in



Exhibit 23-24?

A. Yes.

Q. Would you go on to Exhibit 23-27, please?

A. This page also deals with the pumping circuit, and, apparently, attempts to increase the, what he calls, the linearity of the pumping game circuit, which, I believe, relates to the evenness with which the two players could pump their own buttons without being at a disadvantage because of non-linearities in the circuit. We talked about that before in connection with the various parts values, and this is just more of the same bench work done on the 17th which then winds up with the entry into the book on Exhibit 16, page 32.

Q. Might I direct your attention to page 33 and the circuit on that page?

A. That's the correct page.

Q. Do I understand correctly, then, that the work which is referred to on Exhibit 23-27 forms the basis for, at least, a part of the circuit shown on page 3 of Exhibit 16?

A. That's right.

Q. Prior to this date of May 15, 1967, of Exhibit 23-24,

did Mr. Harrison do any work with respect to producing a moveable dot?

A. I don't remember.

Q. I believe you stated when you saw that exhibit and this was called to your attention that that was the beginning of different work?

A. Yes, at least it is the first time we've seen it in the papers we've gone through. The reference to work on his part -- well, that's no more than an enlargement on 16-4A which shows the same thing.

Q. I believe you stated that 16-4A represented an inoperative circuit?

A. I believe I stated that that was a conceptual sketch.

Q. And that relates to two moveable dots, does it not?

A. That's right.

Q. And that's to be distinguished from the single moveable dot that was referred to in Exhibit 23-24, is that correct?

A. That's right.

Q. Prior to this May 15th date, was there any other reference by you or Mr. Harrison with respect to moveable dots?

MR. WILLIAMS: I object to the question. He's looking for two different things now, things prior to 5/15 relating to dots, and things prior to 5/15 relating to television games in general.

MR. WELSH: Well, then, perhaps --

MR. WILLIAMS: I think you should be looking for one thing at a time.

MR. WELSH: Perhaps it might save time, unless he'd find it difficult to look for both of them.

THE WITNESS: Mr. Welsh, we mentioned earlier there is a whole series of documents under Exhibit 9 that predate, at least in part predate, the 5/16 date, and it's just possible that going through those will answer your question. I don't remember right now whether they were.

Q. (By Mr. Welsh.) Fine. I thought we had discussed most of those, but perhaps this would be a good time, if you could, to look through those and the others here to see that we have before us all of those which relate to the TV games and are earlier than May 18, 1967.

A. And also that relate to moveable spots earlier than May 15th?

MR. WILLIAMS: Just so we don't get off the track, have you finished with Exhibit 23?

THE WITNESS: 23-24, you mean, or all of 23?

Q. (By Mr. Welsh.) I thought you -- did you have anything else to say with respect to the 23 exhibit?

A. No.

MR. WELSH: We went through 23-27, and he found, as I understand it, a few others which were earlier than May 18th. Perhaps --

MR. WILLIAMS: If you think you are completed with Exhibit 23, that's fine.

THE WITNESS: We skipped over 23-28, which I earlier told you is out of sequence. We'll reach it later.

Q. (By Mr. Welsh.) Is it in the sequence after May 18th.

A. Yes, I believe we'll find it, probably, belongs to material -- ought to have been attached to material -- that describes work done sometime in June of '67.

Q. And you are referring to page 53 of Exhibit 16 dated June 5, 1967?

A. That's right or, possibly, even a page or two later.  
So it is definitely out of sequence here.

3 Q. You have a question?

A. Yes, if you can just wait a second.

4 Q. I might say this: if you are going to limit your discussion to -- I mean your search -- to only one of the two items that I requested, that is, any documents relating to TV game development prior to 5/18/67 on the one hand, and documents relating to dot generation on the other hand, which are you going to limit your search to?

A. I was going to look for both, but, clearly, the documents under Exhibit 9 which we've already gone through all related to TV games, so we've already covered that. So in those, I am specifically looking for references to spot generation, and as of now, I have now found one which we had previously noted.

45 Q. Can you select any that you find and set them aside?

A. Yes, I'm trying to do that some way. I am interested in moving on. Through specific references to dot or spot generation occurring prior to May the 18th, '67, the first one being discussed, again, a few minutes ago, and that is the block diagram, Exhibit

16-4A, and the second one is a reference to spot generation on 9-31 which we also discussed yesterday or the day before, near the bottom of the page are the words "Note, cross may become a bright spot with proper video pulse amplitude or ~~the~~ <sup>level clipping</sup> ~~lever~~ <sup>slipping</sup> ahead of the RF modulator," and we had some discussion on that yesterday or the day before, what was meant by driving or RF level.

246 Q. And that involved the generation of a single dot?

A. Single dot, that's correct. Now, once more, since we've gone through all these documents under Exhibit 9 before, clearly, we've picked up before all references to TV games wherever they were as we went along, so I don't have to do that now.

247 Q. Well, I think there may be one there that we have not discussed yet that is earlier than -- dated earlier than May 18th, and that's the 18-44 through 50 which is duplicated in 9-51 through 63?

A. Yes.

248 Q. I don't believe we discussed that. That does relate to TV games, does it not?

A. That's right.

249 Q. Taking Exhibit 9051 through 9 -- strike that.

It appears that although 9-51 through 9-63 is the original, there are some blank pages that have been marked there, so perhaps it would be easier to refer -- does the original have blank pages?

A. Yes, 9-54 is blank. Oh, it is simply because the original is typed with a form of carbon paper which produces a graphite type backing, to make the page more readable, on the back side of the paper, and the blank pages were put in to keep the pages from smearing on the other pages. They are separators, that's why there are blank pages.

Q. Are Exhibits 9-44 through 9-50 a reproduction of those pages of Exhibits 9-51 through 9-42 which have information on them?

A. That's correct.

Q. Perhaps it would be easier, since there are no blank pages, then, to refer to Exhibits 9-44 through 9-50. Could you tell us, please, what is this document?

A. It is a memo from Bill Rusch to R. Baer, myself, under the subject heading "miscellaneous ideas for TVG," which stands for TV games. Memo is dated May 10, 1967.

52 Q. What is the file reference indicated in the upper right-hand portion of this document?

A. The file reference refers to a file number assigned by my then secretary to data in my file as indicated by the initials R. B. which is R. Baer - D. C., which was the secretary's initials, Dottie something or other. <sup>1-2300</sup>~~122300~~, which was my division's number; 67, the year; 92, evidently a consecutive number which means that my secretary did the work of typing up this memo for Bill Rusch.

253 Q. Does your signature appear in the upper right-hand corner?

A. No, it does not. That's, probably, the secretary's signature, and says that this copy was meant for me and, probably, other copies for Rusch and, I would guess, Harrison.

254 Q. Was this copy taken from your file?

A. Yes.

255 Q. What date does the document bear?

A. May 10, 1967.

256 Q. Was Mr. Rusch associated with the TV game project at that time?

A. Yes, he was.



Q. His name has not come up prior to this time, as I recall.

A. That's correct.

Q. What did he have to do with the TV game project at the date of this memo?

A. Using this memo as a memory primer, I called, asked him to join the group, directed him to join the group. The group being myself and Mr. Harrison at the time, because we needed help to move the project forward faster. This memo indicates that he joined us sometime in the early part of May.

Q. Was he -- or were you acquainted with him prior to this time?

A. Yes, he was an electronics engineer in the electronic design department which was part of my division.

Q. What was the name of that division, again?

A. Equipment design division.

Q. Do you know what occasioned his preparation of this memo or the circumstances surrounding its preparation?

A. Well, I can only surmise what happened. Rusch, Harrison, and myself discussed on various occasions various approaches to games, and I asked Bill Rusch

to sit down and put ideas down on paper so we'd have something for discussion purposes and decision making purposes, and he responded by turning out this memo.

262 Q. Was he asked to do this, to prepare this memo so that you would have something to discuss?

A. Well, I assume, again, that it was partially a summary \*  
^ of things we had discussed and partially new material. No way to reconstruct that now.

263 Q. I believe you said you surmise before, or you assume. What is the basis for that surmising or assumption?

A. Simply the circumstances of the situation in which we had a free exchange of cooperative effort underway which resulted in many discussions and, certainly, being unrecorded, it makes it hard to remember who said \*  
what.

264 Q. Did Mr. Rusch participate in any of the work of Mr. Harrison up to May 18, 1975 -- '67, excuse me?

A. No, sir.

265 Q. What was the extent of Mr. Rusch's contact with you and Mr. Harrison around the time of this memo, early May, 1967?

A. As I said, Mr. Welsh, I surmise just about that time

I asked him to join us, and I assume that we briefed him on what had gone before and what we were after and asked him to contribute to ideas and solutions, and he responded with <sup>a</sup>the first act by grinding out this memo. \*

166 Q. Did he have any regular participation in the TV game project at that time?

A. Prior to this?

267 Q. At this time.

A. Yes. Again, I am assuming that by this date I had brought him up on board officially, which by definition means that he was probably charging the same task number that Harrison was charging which, at that time, was NFGAA.

268 Q. Would that have appeared on his memo if that were the case?

A. It should have.

269 Q. Does the fact that it does not indicate that perhaps he was not charging time to that at that time?

A. No, I think it indicates that he was careless and that I was careless and my secretary was careless.

270 Q. Did he have other duties at this time other than working on the TV game project?

A. He may during the first few days he joined the group, but he was assigned to work for me full time on the project sometime around this period.

271 Q. Well, if he had been assigned to work full time on the project, would he not have assisted Mr. Harrison in the work that we've been discussing as reflected by Mr. Harrison's notes, Exhibit 23, and notebook entries in Exhibit 16?

A. He might have, but I, again, reconstructing what might have happened, I didn't bring him on board to help Harrison clean up the circuitry which we were building, but to come up with new ideas, because Bill Rusch is a very creative individual. I had occasion to work with him on other programs. That's why I asked him to join us. I certainly didn't employ Bill Rusch to do trouble-shooting on Harrison's circuitry, though somewhere downstream I'm sure he may have contributed that kind of help.

272 Q. Do you recall, specifically, whether he was working full time on the TV game project as of May 10, 1967, or only part time?

A. I don't recall that, specifically. I can only surmise.

173 Q. What is your surmise?

A. That he had started on the program at least a week or two prior to the date of this memo, because it always took at least a week to get him to write a memo.

274 Q. Would his -- strike that.

Did he keep a notebook, do you know?

A. Yes, several. We have them all in this room.

275 Q. Would those reflect whether or not he was working on this project at that time?

A. It probably would.

MR. WELSH: Off the record.

(Discussion off the record.)

MR. WELSH: Back on the record.

I would like to adjourn this deposition to resume on February 3d, subject to the discussion that we had this morning.

MR. WILLIAMS: Yes.

MR. WELSH: And I would also like to note that when we return to Maine or Massachusetts on January 20th for Mr. Russell's deposition, I would like to continue those from day

to day until they're completed, even if they extend over three days, because I understand that he is leaving on an assignment out of the country. I don't expect that they will extend beyond the three days, but as you advised us yesterday or the day before that you had intended to go beyond the two days that we had understood originally would be used in California next week, I just wanted to let you know now that if this extends beyond that, we do plan to complete Mr. Russell's deposition on that trip.

MR. BRIODY: Through Friday,  
you mean?

MR. WELSH: If necessary.

MR. BRIODY: But not through  
Saturday?

MR. WELSH: If not Saturday,  
then resuming on Monday, because we have to. He  
is leaving.

MR. BRIODY: I thought you said  
you were tied up that last week.

MR. WELSH: I am, starting Tuesday.

MR. WILLIAMS: We have a prior

commitment for Monday, the 26th, and I believe a prior commitment for Friday, January 23d, but we'll try and cooperate with you and work it out. We want to get through, too.

MR. WELSH: That completes this session.

Ralph H. Ider

Deponent

THE STATE OF New Hampshire )  
COUNTY OF Hillsborough ) ss.

Subscribed and sworn to before me this 10th

day of May, 1976.

Marilyn E. Treadis  
~~Justice of the Peace and/or~~  
Notary Public

Marilyn E. Treadis

Notary Public

My Comm. Expires

3-31-1981

MR. WILLIAMS: You mean Exhibit 28.

THE WITNESS: Exhibit 28, rather, and found some of the wires emanated to the outside world from that point, which led to discussion of what goes where.

Q. (By Mr. Welsh.) Returning now to 16-31A, does that drawing contain some changes from its original condition?

A. Yes.

Q. We've already discussed a couple of those changes, haven't we?

A. Yes.

Q. With respect to the change with the letter A in a circle and the line leading to the point between the 100K and the 20K resistors of the D.M.V., did you make that change?

A. Yes, that's my pencilled-in letter A, and the line that accompanies it looks like my handwriting.

Q. When did you make that change?

A. I don't know.

Q. It was subsequent to May 15, 1967, was it not?

A. Yes. I'd like to direct your attention to 9-64 where that same letter A is shown as the output of